



Organization of the Scientific Research

1. Research methodology

2. Organization of Research

Work program of the discipline (Syllabus)

Course Requisites

Educational level	<i>Third (PhD)</i>
Field of knowledge	<i>12 Information technology</i>
Specialty	<i>121 Software Engineering</i>
Educational program	<i>Software Engineering</i>
Course status	<i>Normative</i>
Form of study	<i>Part-time</i>
Year of study, semester	<i>2 year, autumn and spring semester</i>
Number of ECTS credits	<i>4 ECTS credits (120 hours), of which 36 study hours (24 hours of lectures, 12 hours of practical training), 84 hours of self-study</i>
End-of-semester control / control measures	<i>Credit and Exam / modular test, abstract</i>
Timetable	<i>http://rozklad.kpi.ua/</i>
Language of study	<i>English</i>
Information about course leader / teachers	Lecturer: Ph.D., prof. Barabash Oleg Volodymyrovych, bar64@ukr.net Practical training: Ph.D., prof. Barabash Oleg Vladimirovich, bar64@ukr.net
Course placement	<i>http://campus.kpi.ua/</i>

Curriculum

1. Description of the discipline, its purpose, subject of study and learning outcomes

The discipline "Organization of research and innovation" studies a set of interconnected systems that make up the organization of research and innovation and the formation of effective strategies for personnel management, as one of the ways to improve the results of enterprise management in information technology.

The purpose of the discipline is to form higher competencies in higher education students:

- Ability to critically analyze, evaluate and synthesize new and complex ideas in software engineering.*
- Ability to develop and implement software projects, including their own research, which provide an opportunity to rethink existing and create new holistic knowledge.*
- Ability to critically rethink existing software engineering technologies and track trends.*
- Ability to develop technical documentation for research projects.*

- Ability to design scientific reports and publications on research in accordance with existing standards and norms of academic integrity.*
- Ability to search, process and analyze information from various sources.*
- Ability to critically analyze, evaluate and synthesize new and complex ideas.*
- Ability to rethink existing and create new holistic knowledge and / or professional practice and to solve significant social, scientific, cultural, ethical and other problems.*

- Ability to expand the boundaries of knowledge using the results of original research.
- Ability to ensure continuous self-development and self-improvement, responsibility for the development of others in the professional field, adhering to pedagogical ethics, the rules of academic integrity in scientific and pedagogical activities.
- Ability to use adequate methods of effective interaction with representatives of different groups (social, cultural and professional).
- Ability to work in a team, form positive relationships with colleagues, communicate with the general scientific community and the public in the field of software engineering.
- Ability to lead in the initiation and implementation of complex innovative international projects.

Subject of academic discipline: methods of organization of scientific and innovative activity; ways to increase the competitiveness of products in domestic and foreign markets; preservation of scientific and technical potential.

As a result of studying the discipline, applicants for higher education will acquire the following general program learning outcomes:

- Deeply understand the general principles and methods of software engineering, as well as research methodology, apply them in their own research in the field of software engineering and in teaching practice.
- Have advanced conceptual and methodological knowledge in software engineering and at the boundaries of subject areas, as well as research skills sufficient to conduct scientific and applied research at the level of modern world achievements in the field, gaining new knowledge and / or innovation.
- Freely present and discuss with experts and non-specialists the results of research, scientific and applied problems of software engineering in state and foreign languages, qualified to reflect the results of research in scientific publications in leading international scientific journals.
- Be able to develop new and improve existing models, methods, tools in the field of software engineering, which ensure the development of technologies for software development and use.

During the study of the discipline "Organization of scientific and innovative activities" are used:

- method of problem-oriented learning;
- active learning strategy, according to which the teacher's communication with graduate students is carried out through surveys, independent, tests, tests, etc. ;
- personality-oriented development technologies based on active forms and methods of learning (team-based learning), pair work (think-pair-share), brainstorming, etc.);
- heuristic methods (methods of creating ideas, methods of solving creative problems, methods of activating creative thinking).

Pedagogical practice in the system of higher education at the third educational and scientific level is a component of professional training for scientific and pedagogical activities and is a type of practical activity of graduate students involving participation in the organization and implementation of teaching activities in higher education. research work. During pedagogical practice, students of higher education develop their own style of pedagogical activity. Pedagogical practice promotes the development of professional self-awareness, culture of communication, the formation of theoretical, practical and personal-motivational components of professional competence of trainees. The formation of practical skills and abilities of the graduate student is carried out during lectures, practical, laboratory classes, the organization of independent work of higher education. During this practice there is an opportunity to test the results of research conducted by graduate students during the writing of the dissertation.

The object of practice is the real interaction of participants in the pedagogical process.

Subject - patterns, techniques, methods and methods of this interaction, due to its goals, objectives and content.

The purpose of pedagogical practice is to provide graduate students with the following competencies:

- Ability to carry out and organize scientific and pedagogical activities in higher education using the latest pedagogical approaches and practices, including information technology in the educational process, to diversify teaching methods in order to better perceive the material.

- Ability to ensure continuous self-development and self-improvement, responsibility for the development of others in the professional field, adhering to pedagogical ethics, the rules of academic integrity in scientific and pedagogical activities.

As a result of pedagogical practice, applicants for higher education will acquire the following program learning outcomes:

- Have modern methods of teaching in higher education, be able to teach professionally-oriented disciplines of the specialty on the basis of systematic, methodological knowledge of the specialty and the results of scientific research using basic knowledge of pedagogy and psychology of higher education.

- Know the basics of planning the educational process in higher education, tasks and functions of research and teaching staff, requirements for the preparation of documentary support of the educational process, have skills in organizing pedagogical activities, planning classes.

- Develop content, structure educational material, choose methods of teaching and control, monitor and evaluate learning outcomes and correct the educational process during teaching, know the psychological and didactic foundations of the learning process, taxonomy of learning objectives and methods of enhancing cognitive activity of students.

- Have advanced conceptual and methodological knowledge in software engineering and at the boundaries of subject areas, as well as research skills sufficient to conduct scientific and applied research at the level of modern world achievements in the field, gaining new knowledge and / or innovation.

- Freely present and discuss with experts and non-specialists the results of research, scientific and applied problems of software engineering in state and foreign languages, qualified to reflect the results of research in scientific publications in leading international scientific journals.

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

The discipline "Organization of scientific and innovative activities" requires knowledge of the disciplines of PhD degree in specialty 121 "Software Engineering".

3. The content of the discipline

SECTION 1

Topic 1. Theoretical and methodological principles of innovation.

Topic 2. Innovative processes as an object of organization and management.

Topic 3. Forms of innovation.

Topic 4. Comprehensive assessment of the effectiveness of innovation.

Modular test work.

Test.

SECTION 2

Topic 5. Science and research. Research technology.

Topic 6. Scientific publications.

Topic 7. Types of research work.

Modular test work.

Exam.

PRACTICAL TRAINING

1. *The essence and prerequisites for the development of innovation in business structures.*
2. *Management of research and development work.*
3. *Organization of management and regulation of innovation program implementation.*
4. *Organization of research work in a higher education institution.*
5. *The use of software for mathematical modeling and validation of scientific results*
6. *Publication of scientific results. Mechanisms for evaluating the results of scientific activities.*

4. Training materials and resources

Basic literature:

1. *Алейнікова О. В. Інноваційний та інвестиційний менеджмент. Навчальний посібник / О. В. Алейнікова, Н. М. Прутула – Київ: ДВНЗ «Університет менеджменту освіти», 2016. – 614 с.*
2. *Бубенко П.Т. Регіональні аспекти інноваційного розвитку : [монографія] / П.Т. Бубенко. – Х.: НТУ «ХПІ», 2002. – 316 с.*
3. *Василенко В.О. Інноваційний менеджмент : навч. посіб. / В.О. Василенко. – К.: ЦУЛ, Фенікс 2003. – 440 с.*
4. *Геєць В.М. Інноваційні перспективи України / В.М. Геєць, В.П.Семіноженко. – Х.: Константа, 2006. – 272 с.*
5. *Ілляшенко С.М. Управління інноваційним розвитком / С.М. Ілляшенко. – Суми: Університ. кн., 2003. – 278 с.*
6. *Основи методології та організації наукових досліджень: Навч. посіб. для студентів, курсантів, аспірантів і ад'юнтів / за ред. А.Є. Конверського. – К.: Центр учбової літератури, 2010. – 352 с.*
7. *Dharmapalan V. Scientific Research Methodology / V. Dharmapalan. – Alpha Science, 2012. – 250 p.*
8. *Економічні дослідження (методологія, інструментарій, організація, апробація): навч. посібн.; за ред. А.А. Мазаракі. – К.: Київ. нац. торг.-екон. ун-т., 2010. – 280 с.*
9. *Демківський А.В. Основи методології наукових досліджень: навч. посібн. / А.В. Демківський, П.І. Безус. – К.: Акад. муніцип. упр., 2012. – 276 с.*
10. *Prathapan K. Research Methodology for Scientific Research. / K. Prathapan. – Dreamtech Press, 2019. – 272 p.*
11. *Краус Н.М. Методологія та організація наукових досліджень: навч.-метод. посібн. / Н.М. Краус; Полтав. нац. техн. ун-т ім. Ю. Кондратюка. – Полтава : Оріяна, 2012. – 180 с.*
12. *Рябчій В. А. Теорія похибок вимірювань: навч. посібник / А. В. Рябчій, В. В. Рябчій ; М-во освіти і науки України, Нац. гірн. ун-т., 2006. – 165 с.*

Additional literature:

13. *Khine M.S. Advances in Nature of Science Research: Concepts and Methodologies/ M.S. Khine. – Springer, 2012. – 268 p.*
14. *Крушельницька О.В. Методологія та організація наукових досліджень : навч. посібн. / О.В. Крушельницька. – К.: Кондор, 2003. – 192 с.*

15. Н Мочерний С В. *Методологія економічного дослідження / С.В. Мочерний.* – Львів: Світ, 2001. – 416 с.
16. Пономаренко В.С. *Аналіз даних у дослідження соціально-економічних систем / В.С. Пономаренко, Л.М. Малярець.* – Х.: ВД "ІНЖЕК", 2009. – 432 с.
17. Білуха М Т. *Методологія наукових досліджень / М.Т. Білуха.* – К.: АБУ, 2002. – 480 с.
18. Marik B. "When Should a Test Be Automated?", *Testing Foundations*, 1998, pp.1-20.
19. Су Клименюк О.В. *Методологія та методи наукового дослідження: навч. посібн. / О.В. Клименюк.* – К.: Міленіум, 2005. – 186 с.
20. Khine M.S. *Advances in Nature of Science Research: Concepts and Methodologies/ M.S. Khine.* – Springer, 2012. – 268 p.
21. Крушельницька О.В. *Методологія та організація наукових досліджень : навч. посібн. / О.В. Крушельницька.* – К.: Кондор, 2003. – 192 с
22. Пономаренко В.С. *Аналіз даних у дослідження соціально-економічних систем / В.С. Пономаренко, Л.М. Малярець.* – Х.: ВД "ІНЖЕК", 2009. – 432 с.
23. Білуха М Т. *Методологія наукових досліджень / М.Т. Білуха.* – К.: АБУ, 2002. – 480 с.
24. Клименюк О.В. *Методологія та методи наукового дослідження: навч. посібн. / О.В. Клименюк.* – К.: Міленіум, 2005. – 186 с.

Educational content

5. Methods of mastering the discipline (educational component)

Lectures

№	Type of educational activity	Description
Section 1		
Topic 1. Theoretical and methodological principles of innovation.		
1	Lecture 1. Essential characteristics of innovations and innovation processes.	The essence, objects and subjects of innovation. Stages, stages and models of the innovation process. Classification of innovations. Life cycle of innovations. Tasks on self-study: Formation and current trends in innovation.
Topic 2. Innovative processes as an object of organization and management		
2	Lecture 2. Formation and current trends in the development of innovation and business theories.	The theory of cyclical economic development. Innovative theories of technological change. Theories of technocratic society. Modern concepts of innovative development. Innovative type of development. Tasks on self-study: The essence and classification of innovations.

3	Lecture 3. Features of creating innovations and forming demand for them.	Conditions for the emergence of demand for innovation. Planning and organization of new product creation. Types of demand for innovation and factors influencing it. Tasks on self-study: planning and organizations to create a new product.
Topic 3. Forms of innovation		
4	Lecture 4. Innovation policy of the enterprise.	The essence and objectives of innovation policy of the enterprise. Principles of innovation policy formation. Components of innovation policy. Tasks on self-study: types of demand for innovation and factors influencing it.
5	Lecture 5. Update of technical and technological base enterprises.	Machinery and technology are components of the technical and technological base of the enterprise. Technical development and indicators of the technical level of the enterprise. Restoration and improvement of technical and technological base of the enterprise. Tasks on self-study: the essence and objectives of innovation policy of the enterprise.
Topic 4. Comprehensive assessment of the effectiveness of innovation		
6	Lecture 6. Innovation process management system and modern organizational forms implementation of innovations.	Innovation as an object of management. Tasks of the innovation management system. Strategic management of innovation. Operational management of innovation. Tasks on self-study: preparation for MCR.
Modular test work		
Section 2		
Topic 5. Science and research. Research technology		
7	Lecture 7. Science and research. Research technology.	The emergence and evolution of science. Theoretical and methodological principles of science. Types and features of scientific research. Methodology and research methods. Organization of scientific activity in Ukraine. General characteristics of research processes. Formulation of the research topic and definition of the working hypothesis. Defining the purpose, objectives, object and subject of research. Execution of theoretical and applied research. Preparation of a report on the research work performed. Tasks on self-study: levels of scientific and scientific-technical activity.

8	Lecture 8. Theory of errors in a scientific experiment	<p>Exact and approximate numbers. Sources of errors. Classification of errors. Errors of measured values. Systematic errors. Random errors. Elements of error theory. Calculation of errors during direct measurements. Rounding error. Absolute and relative errors of measured values. Calculation of absolute and relative errors in indirect measurements. Rounding rules in approximate calculations. Decimal notation of approximate numbers.</p> <p>Significant number numbers. A really significant figure. The relationship between the number of valid characters and the error of the number.</p>
		<p>Function error. Errors of sum, difference and product. Computational experiment and its main stages. The concept of stability and correctness. Examples of calculation of errors based on the results of measurements of the studied values.</p> <p>Tasks on self-study: certification and professional development of researchers.</p>
9	Lecture 9. Modeling in research. Visualization of research results.	<p>Modeling as a method of scientific knowledge. Features of application of the scientific method of mathematical modeling. Features of scientific observations and measurements. Randomness and uncertainty in research. Checking the adequacy of models. Classification of mathematical models. Areas of scientific visualization. Computer modeling. Visualization of information. Interface and perception technology. Surface rendering. Volume rendering. Three-dimensional visualization.</p> <p>Tasks on self-study: forms of development of scientific knowledge.</p>
Topic 6. Scientific publications		
10	Lecture 10. Scientific publications. Use of specialized publishing systems.	<p>Bibliographic apparatus of scientific research. Types of scientific publications. Scientific monograph. Scientific Article. Abstracts of the scientific report. Scientific report (presentation). Rules of registration of publications. Rules for compiling a bibliographic description for bibliographies and sources. Rules of bibliographic description of certain types of documents. Examples of bibliographic description of certain types of documents. Location of bibliographic descriptions in bibliographies. Rules for quoting and bibliographic references in the texts of scientific and educational works. Search for scientific publications for publication based on research results.</p> <p>Tasks on self-study: methods of analysis and processing of statistical information.</p>

11	<p>Lecture 11. Types of research work. Preparation dissertation work.</p>	<p>Research work in a higher education institution. Participation of graduate students in the research of graduating departments. Participation in scientific conferences, symposiums, forums. Participation in thematic scientific schools, internships, exchange of experience. Implementation of research results in the practical activities of organizations, enterprises and firms. General characteristics of the dissertation of OS "Doctor of Philosophy". The sequence of dissertation work</p> <p>OS "Doctor of Philosophy". Preparatory stage of work on the dissertation. Work on the text of the dissertation. Registration of dissertation work.</p> <p>Tasks on self-study: information resources and technologies in research.</p>
Topic 7. Types of research work		
12	<p>Lecture 12. Participation in scientific projects, grants, academic mobility programs.</p>	<p>Features of financing scientific activity in Ukraine and abroad. Participation in research projects (R&D) at the expense of the state budget of Ukraine. The main selection criteria and requirements for participants in the competition of research projects of the Ministry of Education and Science of Ukraine. Joint international research projects under the auspices of the Ministry of Education and Science of Ukraine. Grants - as a mechanism for targeted funding for a specific area of research. Grants and research support funds. Academic mobility. Academic mobility programs: ERASMUS +, Mitacs Globalink Research Internship, German Academic Exchange Service DAAD, Fulbright Research and Development, etc. Participation in competitions to finance academic mobility.</p> <p>Tasks on self-study: procedures for reviewing and preparing for the defense of works.</p>
Modular test work		

Practical training:

№	Type of educational activity
1	Practical activity 1. The essence and prerequisites for the development of innovation in business structures
2	Practical activity 2. Management of research and development work.
3	Practical activity 3. Organization of management and regulation of innovation program implementation.
4	Practical activity 4. Organization of research work in a higher education institution

5	Practical activity 5. The use of software for mathematical modeling and validation of scientific results.
6	Practical activity 6. Publication of scientific results. Mechanisms for evaluating the results of scientific activities.

6. Self-study

The discipline "Organization of scientific and innovative activities" is based on independent preparation for classroom classes on theoretical topics.

№	Topic for self-study	Hours	Reference
Section 1			
1	Preparation to the lecture 1 Formation and current trends in innovation.	5	1, 3-4
2	Preparation to the lecture 2. The essence and classification of innovations.	4	1, 3
3	Preparation to the lecture 3. Planning and organization of new product creation.	4	1, 3
4	Preparation to the practical activity 2. Types of demand for innovation and factors influencing it.	4	1, 3
5	Preparation to the lecture 4. The essence and objectives of the innovation policy of the enterprise.	4	1, 3
6	Preparation to the practical activity 3. Principles of formation of innovation policy of the enterprise.	4	1, 3
7	Preparation to the lecture 5. Concepts, tasks, subjects and objects of innovation management.	4	1, 3
8	Preparation to the lecture 6. Development of the concept of innovation strategy.	4	1, 3
9	Preparation for the module test on all material of the module.	10	1-5, 13-19
Section 2			
10	Preparation to the lecture 7. Levels of scientific and scientific-technical activity.	5	6, 8-9
11	Preparation to the lecture 8. Certification and advanced training of researchers.	4	6, 8
12	Preparation to the lecture 9. Forms of development of scientific knowledge.	4	6, 8
13	Preparation to the lecture 10. Methods of analysis and processing of statistical information.	4	6, 8
14	Preparation to the lecture 11. Information resources and technologies in research.	4	6, 8
15	Preparation to the practical activity 5. Bibliographic description of sources used in research.	4	6, 8

16	<i>Preparation to the lecture 12. Procedures for reviewing and preparing for the defense of works.</i>	4	6, 8
17	<i>Preparation to the practical activity 6. The procedure for identifying and establishing the facts of violation of academic integrity</i>	4	6, 8
18	<i>Preparation for the module test on all material of the module</i>	10	6-12, 20-24

Policy and control

7. Policy of academic discipline (educational component)

- *Attendance at lectures and practical classes is a mandatory part of studying the material.*
 - *At the lecture the teacher uses his own presentation material; uses Google Drive to teach the material of the current lecture, additional information, etc .; the solution of modular control work is downloaded to Google Drive; at lectures it is forbidden to distract the teacher from teaching the material, all questions, clarifications, etc. students ask at the end of the lecture in the allotted time.*
 - *Modular test is written in a lecture without the use of aids (mobile phones, tablets, etc.); the result is uploaded to the file via Google form to the appropriate directory of Google disk.*
- Incentive points are awarded for:*
- *incentive points are set for: solving problems in face-to-face practical classes; participation in faculty and institute Olympiads in academic disciplines, participation in competitions, preparation of reviews of scientific papers, etc. Number of encouraged points not more than 1;*
 - *active work at lectures - the number of encouraged points is not more than 8.*
- Attendance and assignments are a mandatory component of the assessment for which points are awarded.*
- Adherence to the policy of integrity.*
- Postgraduate students who have not completed the internship program, or whose work is defined as unsatisfactory, are obliged by the decision of the Faculty Council to repeat the internship without interruption, or in accordance with the Regulations on training of scientific, pedagogical and scientific staff approved by the Cabinet of Ministers March 19, 1999 No. 309, subject to expulsion from graduate school of the university.*

8. Types of control and rating system of assessment of learning outcomes (RSO)

During the semester, graduate students perform 6 practical tasks. The maximum number of points for each lesson is 7 points.

Points are awarded:

7 points - a complete answer to the question during the defense (not less than 90% of the required information), the practical task is performed correctly;

4-6 points - a fairly complete answer to the question during the defense (at least 75% of the required information), the practical task is performed correctly;

2-3 points - incomplete answer to the question during the defense (not less than 60% of the required information), minor errors in the practical task;

1 point - unsatisfactory answer and / or significant errors in solving a practical problem

Maximum number of points for practical classes:

7 points × 6 software = 42 points.

The task for the modular test consists of 5 questions, each evaluated by 10 points.

Criteria for evaluating each test question:

9-10 points - complete answer (not less than 90% of the required information), the task is solved without errors, actions are justified;

7-8 points - a fairly complete answer (at least 75% of the required information), the problem is solved without significant errors;

5-6 points - incomplete answer, in some problems there may be significant errors, but at least 60% are solved correctly;

1-4 points - unsatisfactory answer (incorrect solution of problems), requires re-writing the work at the end of the semester.

Maximum number of points for MCR:

10 points × 5 tasks. = 50 points.

The rating scale for the discipline is equal to:

$R_c = R_{\text{practice}} + \text{Interrogation} + R_{\text{MKR}} = 42 \text{ points} + 8 \text{ points} + 50 \text{ points} = 100 \text{ points.}$

Calendar control: conducted twice a semester to monitor the current state of compliance with the requirements of the syllabus.

At the first attestation (8th week) the student receives "credited" if his current rating is not less than 50% of the maximum number of points that a student can receive before the first attestation.

At the second attestation (14th week) the student receives "credited" if his current rating is not less than 50% of the maximum number of points that a student can receive before the second attestation.

Semester control - exam.

Composition and evaluation criteria of the exam.

The exam task consists of 2 questions (tasks). Each question (task) is evaluated with 25 points.

Criteria for grading each exam question:

23-25 - complete answer, not less than 90% of the required information, performed in accordance with the requirements for the level of "skills" (complete, error-free solution of the problem);

20-22 - sufficiently complete answer, not less than 75% of the required information, performed in accordance with the requirements for the level of skills or there are minor inaccuracies (complete problem solving with minor errors);

15-19 points - incomplete answer, not less than 60% of the required information, performed in accordance with the requirements for the "stereotypical" level and some errors;

0 points - no answer or the answer is incorrect.

Maximum number of points for the exam:

25 points × 2 questions = 50 points.

The sum of starting points and points for the examination test is transferred to the examination grade according to the table:

Table of correspondence of rating points to grades on the university scale:

<i>Number of points</i>	<i>Grades</i>
100-95	Excellent
94-85	Very good
84-75	Good
74-65	Satisfactorily
64-60	Sufficiently
Less 60	Unsatisfactory
Admission conditions are not met	Not allowed

Work program of the discipline (Syllabus):

Developed by Professor, Ph.D., Prof. Barabash Oleg Volodymyrovych

Approved by department _____ (protocol № __ from _____)

Resolved by Methodical commission of the faculty (protocol № __ from _____)